Pamphlet accompanies map

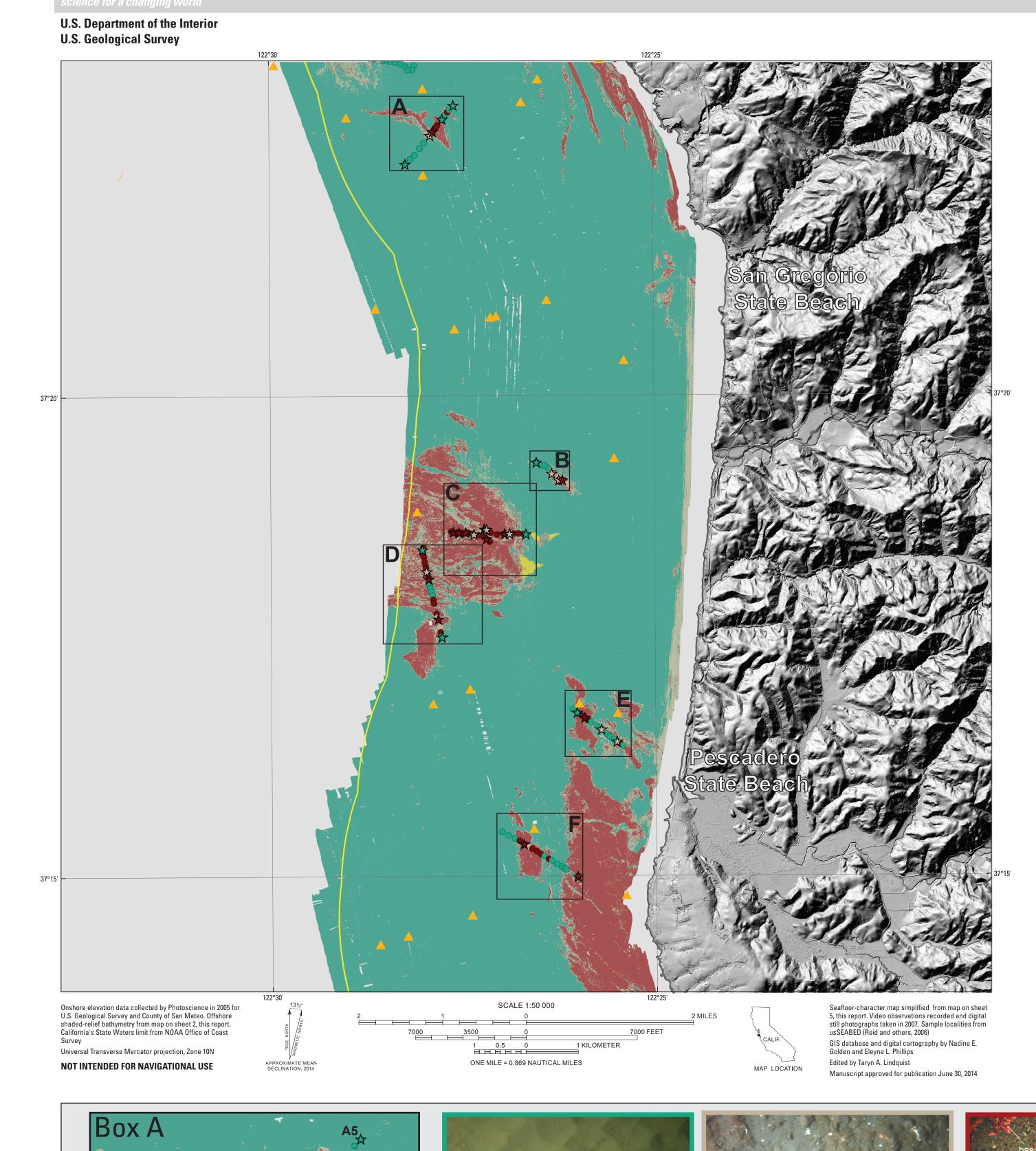


Figure 1B. Digital still photograph no. A1 (see fig. 1A for location).

lasers (red dots) is 15 cm.

Figure 1A. Detailed view of seafloor character mapped northwest of San Gregorio State Beach,

approximately 4.5 km offshore (see Box A, on map, for location), showing locations of periodic

real-time video observations (dots) and digital still photographs (stars; see figs. 1B through 1F)

Figure 2A. Detailed view of seafloor character mapped southwest of San Gregorio State

through 2E) from camera line CAM13, cruise F–3–07–NC.

Beach, approximately 3 km offshore (see Box B, on map, for location), showing locations of

periodic real-time video observations (dots) and digital still photographs (stars; see figs. 2B

from camera line CAM1, cruise F-3-07-NC.

Unconsolidated, fine- to medium-grained sand with sharp-crested

ripples in confused pattern (water depth, 31 m). Abiotic complexity is

Figure 2B. Digital still photograph no. B1 (see fig. 2A for location). Fine-

(water depth, 27 m). Abiotic complexity is low, biotic complexity is

absent, and biocover is moderate. Biocover includes tubeworm (tw),

hydroid (h), and bat star (bas). Distance between lasers (red dots) is 15

to medium-grained sand with sharp-crested ripples in confused pattern

low, biotic complexity is absent, and biocover is low. Distance between

Figure 1C. Digital still photograph no. A2 (see fig. 1A for location).

complexity is moderate, biotic complexity is absent, and biocover is

Distance between lasers (red dots) is 15 cm.

gure 1E. Digital still photograph no.

A4 (see fig. 1A for location).

medium-grained sand with

no. B3 (see fig. 1A for location). Mixed gravel and fine sand with

shells (water depth, 26 m). Abiotic

complexity is moderate, biotic complexity is absent, and biocover

is moderate. Biocover includes

dots are just out of view in this

image but are visible in previous

video frame) is 15 cm.

encrusting sponge (spo) and bat star

(bas). Distance between lasers (red

nsolidated, fine- to

sharp-crested ripples in confused

pattern (water depth, 29 m). Abiotic

complexity is low, biotic complexity is

absent, and biocover is low. Distance

between lasers (green dots) is 15 cm.

moderate. Biocover includes clam siphon (cs) and tubeworms (tw).

Mixed gravel and cobbles with fine sand (water depth, 29 m). Abiotic

Figure 1D. Digital still photograph no. A3 (see fig. 1A for location).

this image but are visible in previous video frame) is 15 cm.

Figure 2C. Digital still photograph no. B2 (see fig. 2A for location). Interface

between sand with shell hash and mixed boulders and cobbles (water

and biocover is moderate. Biocover includes sea anemone (sa) and

depth, 27 m). Abiotic complexity is moderate, biotic complexity is absent

encrusting sponge (spo). Distance between lasers (red dots are just out of view in this image but are visible in previous video frame) is 15 cm.

Rounded to subrounded boulders and rugose rock (water depth, 30 m).

Abiotic complexity is high, biotic complexity is absent, and biocover is

high. Biocover includes bat star (bas); sea anemone (sa); cup corals (cc);

frilly sea cucumbers (fsc); blackeye goby, Rhinogobiops nicholsii (beg);

and ronguil (r). Distance between lasers (red dots are just out of view in

igure 1F. Digital still photograph

sharp-crested ripples in confused

pattern (water depth, 27 m). Abiotic

omplexity is absent, and biocover

ubeworm (tw) and drift weed (dw).

Distance between lasers (red dots)

gure 2E. Digital still photograph no. B4 (see fig. 1A for location).

overlying bedrock (water depth, 26 m). Abiotic complexity is moderate,

biotic complexity is absent, and

iocover is moderate. Biocover

includes short-spined sea star

(spo). Distance between lasers

(red dots are just out of view in this

mage but are visible in previous

(ssst) and encrusting sponges

deo frame) is 15 cm.

Aixed boulders and cobbles

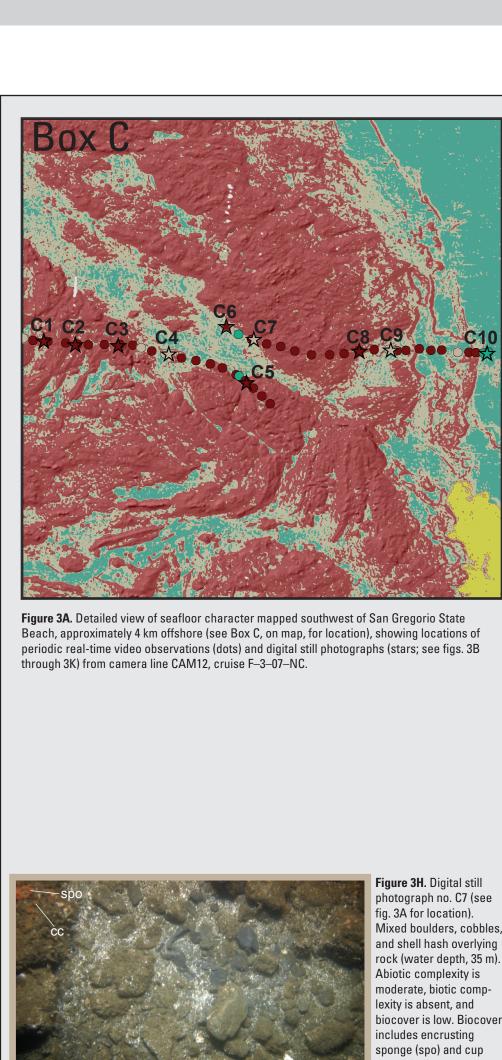
no. A5 (see fig. 1A for location).

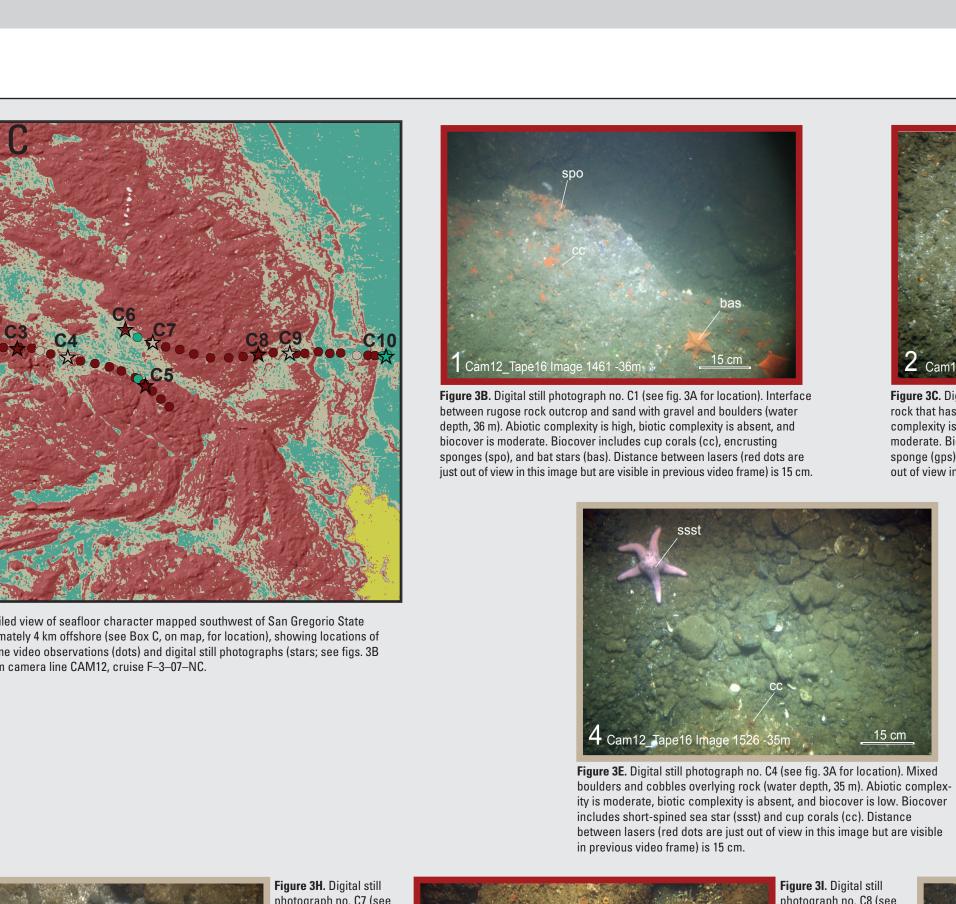
Inconsolidated, fine- to

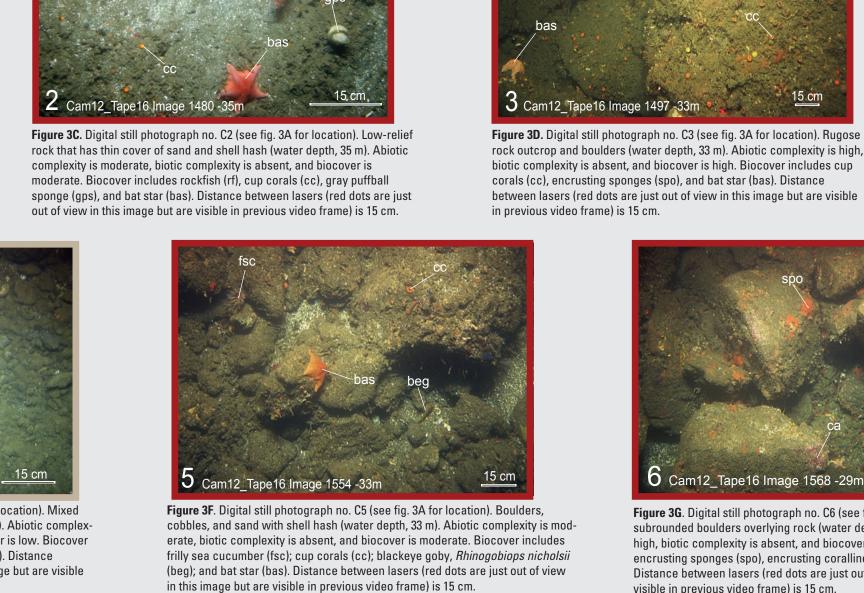
medium-grained sand with

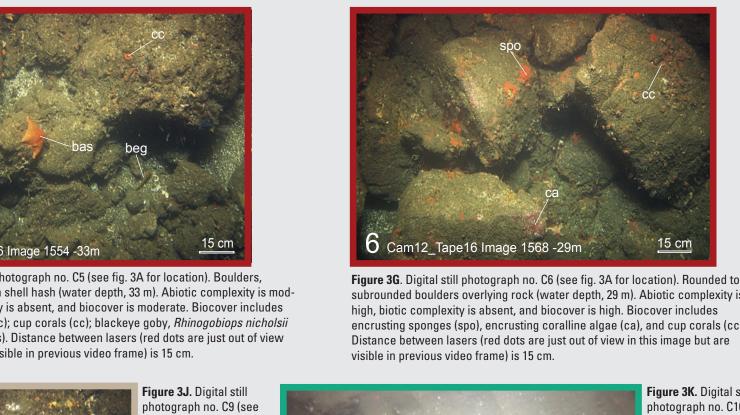
complexity is low, biotic

is low. Biocover includes









10 Cam12_Tape16 Image 1644 -30m ______15 cm

Figure 4D. Digital still photograph no. D3 (see fig. 4A for location).

Rugose rock outcrop that has thin cover of soft, unconsolidated

complexity is absent, and biocover is moderate. Biocover includes

encrusting sponges (spo), 3-dimensional sponges (spo3D), cup corals

(cc), and bat star (bas). Distance between lasers (red dots are just out

of view in this image but are visible in previous video frame) is 15 cm.

Figure 4F. Digital still photograph no. D5

medium-grained sand and shell hash

with sharp-crested interference ripples

(water depth, 40 m). Abiotic complexity

is low, biotic complexity is absent, and

brittle star arms (bs). Distance between

(see fig. 4A for location).

Unconsolidated, fine- to

lasers (red dots) is 15 cm.

sediment (water depth, 41 m). Abiotic complexity is high, biotic

ig. 3A for location).

moderate, biotic

mplexity is absent,

ınd biocover is moder

ate. Biocover includes

between lasers (red

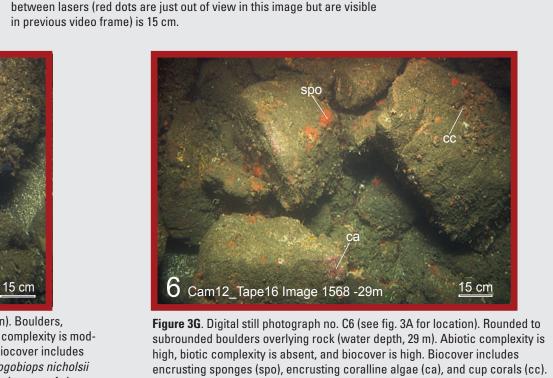
in this image but are

dots are just out of view

oulders, cobbles, and

ravel (water depth, 30

. Abiotic complexity



is moderate. Biocover

includes tubeworms

(tw). Distance between

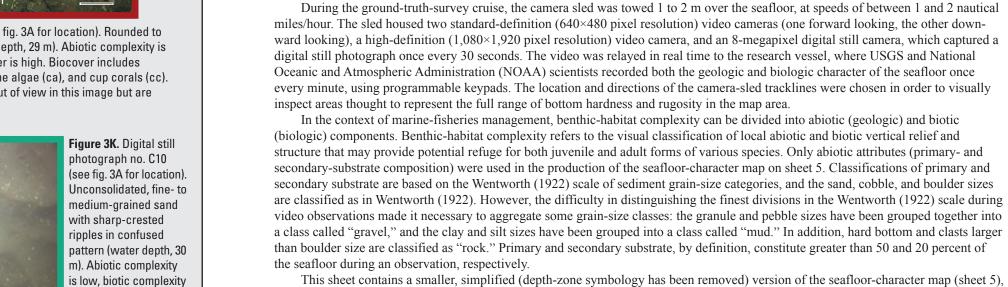
lasers (only one red dot

is visible in this image,

but both are visible in

previous video frame) is

15 cm.



throughout the map area in 2007.

This sheet contains a smaller, simplified (depth-zone symbology has been removed) version of the seafloor-character map (sheet 5), on which the camera-sled tracklines used to ground-truth-survey the sonar data are indicated by aligned colored dots, each dot representing the location of a recorded observation. Primary- and secondary-substrate compositions are shown by differently colored dots. The map also shows the locations of the detailed views of seafloor character along some of the tracklines (Boxes A through F) that are highlighted on this sheet (figs. 1A, 2A, 3A, 4A, 5A, 6A). Also shown are locations of samples (triangles) from usSEABED (Reid and others, 2006) that were used to supplement the ground-truth surveys. The seafloor-character map shows that this area is predominately covered by sandy sediment (see, for example, figs. 1B, 1E, 1F), but it also includes several areas of rocky outcrops. The sandy sediment is characterized by sharp-crested, oscillatory ripples (typical wavelengths, 5 to 15 cm), and the sandy-shelf areas are typified by low abiotic complexity, low biotic complexity, and low biocover. Several large, isolated areas of sedimentary-rock outcrop are present in all

water depths (see, for example, figs. 2E, 3F, 3G, 3I, 4D, 5C, 6C). High-relief rock outcrops support high biocover, including groundfish

DISCUSSION

3-nautical-mile limit of California's State Waters. In order to characterize the bathymetry and acoustic-backscatter data into geologically and biologically useful information, the USGS ground-truth-surveyed the data by towing a camera sled (fig. 7) over specific locations

Between 2006 and 2007, the seafloor in the Offshore of San Gregorio map area in northern California was mapped by Fugro

Pelagos and by California State University, Monterey Bay (CSUMB), using multibeam echosounders (see sheets 1, 2, 3). These mapping missions combined to collect bathymetry and acoustic-backscatter data from about the 10-m isobath to out beyond the

(see, for example, figs. 1D, 2E, 3C, 4D, 5E, 6B). Small areas of moderately to poorly sorted, coarse-grained sand and gravel are located along rock outcrops (see, for example, fig. 1C). Each detailed view (figs. 1A, 2A, 3A, 4A, 5A, 6A) shows the locations of camera-sled tracklines (aligned colored dots), as well as of the photographs (colored stars) taken along the tracklines. These photographs, which are representative of the seafloor, are displayed with a description of the observed seafloor characteristics recorded by USGS and NOAA scientists (figs. 1B through 1F; 2B through 2E; 3B through 3K; 4B through 4F; 5B through 5E; 6B, 6C). Only primary and secondary substrates are reported, although individual photographs may show more substrate types. Organisms, when present, are labeled on the photographs.

Ground-truth surveys in the Offshore of San Gregorio map area include approximately 10.5 trackline kilometers of video and 675 still photographs, in addition to 611 seafloor observations of abiotic and biotic attributes. A visual estimate of slope also was recorded.

GLOSSARY

Rugosity—A GIS-derived characterization of seafloor roughness, calculated as the ratio of the three-dimensional surface area of seafloor to the two-dimensional planar-base area, for each cell in the bathymetry grid. Backscatter intensity—The amplitude of the reflected sonar signal (see sheet 3) used to infer the hardness of the bottom, determined after sonar-data processing has removed (as much as possible) the effects of water depth, angle of reflection, and bottom rough-

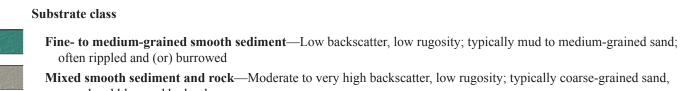
Biocomplexity—The assessment of the presence or absence of biological structures that have the potential of providing shelter for fauna, determined by estimating the scale, the amount, and the morphology of biological relief (as described by Tissot and others, 2006). Biocover—The visual estimate of the proportion of biologic cover by encrusting organisms: high, greater than 50 percent; moderate, between 50 percent and 10 percent; low, less than 10 percent.

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http://pubs.usgs.gov/ds/2006/182/. Tissot, B.N., Yoklavich, M.M., Love, M.S., York, K., and Amend, M., 2006, Benthic invertebrates that form habitat on deep banks off southern California, with special reference to deep sea coral: Fishery Bulletin, v. 104, p. 167–181. Wentworth, C.K., 1922, A scale of grade and class terms for clastic sediments: Journal of Geology, v. 30, p. 377–392.

EXPLANATION



Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose bedrock Anthropogenic material—Related to development by humans

Location of real-time video observation and interpreted substrate class of seafloor Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to medium-grained sand;

often rippled and (or) burrowed **Mixed smooth sediment and rock**—Moderate to very high backscatter, low rugosity; typically coarse-grained sand,

gravel, cobbles, and bedrock Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose bedrock

Location of digital still photograph and interpreted substrate class of seafloor

Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to medium-grained sand; often rippled and (or) burrowed Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically coarse-grained sand,

gravel, cobbles, and bedrock Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose bedrock

Interpreted substrate class depicted in digital still photograph—Indicated by colored frame around photograph (not shown on map; shown in figures only)

Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to medium-grained sand; often rippled and (or) burrowed

Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically coarse-grained sand,

gravel, cobbles, and bedrock

Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose bedrock Sample localities

From usSEABED (Reid and others, 2006) Area of "no data"—Areas near shoreline not mapped owing to insufficient high-resolution seafloor mapping data; areas

beyond 3-nautical-mile limit of California's State Waters were not mapped as part of California Seafloor Mapping

3-nautical-mile limit of California's State Waters



Figure 7. USGS-designed camera sled being loaded onto research vessel in preparation for ground-truth studies. Components onboard sled include four digital video camcorders, one 8-megapixel digital SLR camera, lasers for scale, and various strobe and video lights, as well as telemetry instrumentation that records depth, altitude, and compass heading.





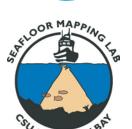


proportions may not be true on plots of this map.

Digital files available at http://pubs.usgs.gov/sim/3306/



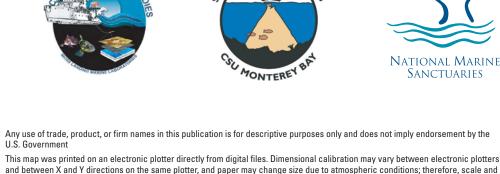
For sale by U.S. Geological Survey, Information Services, Box 25286, Federal Center, Denver, CO 80225, 1–888–ASK–USGS

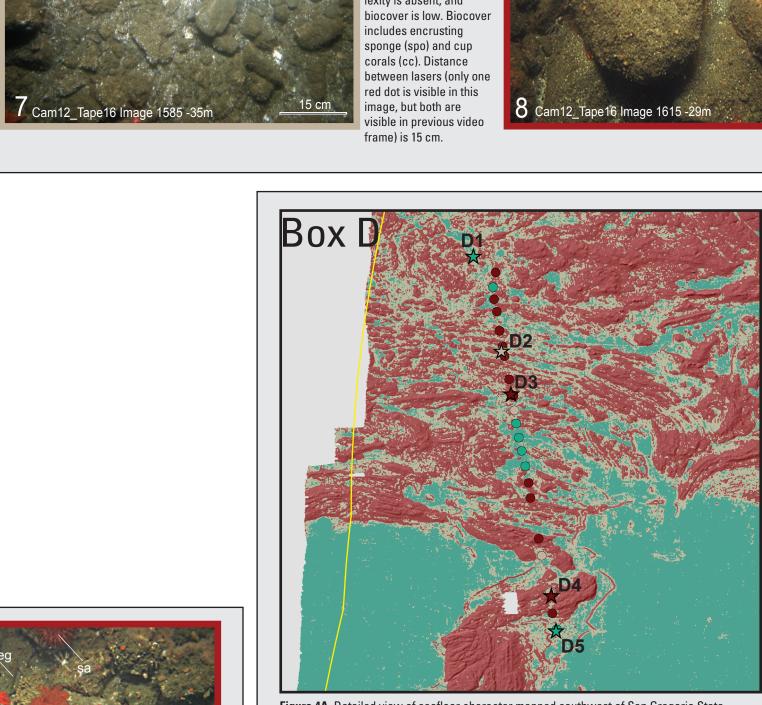


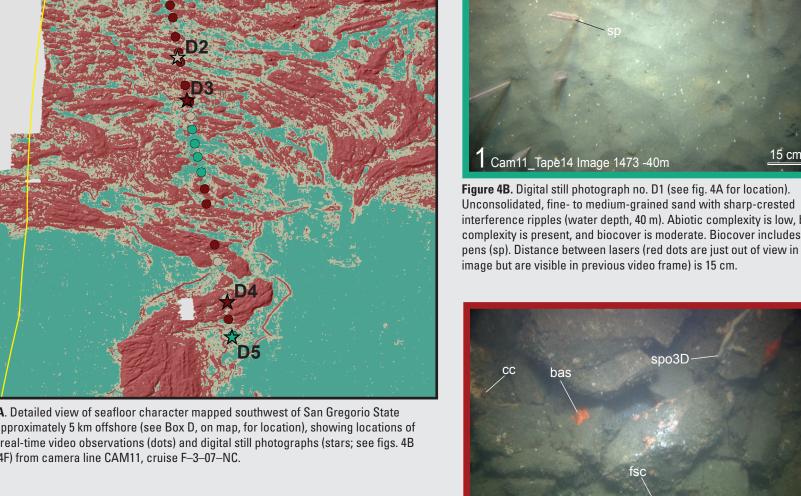




Suggested Citation: Golden, N.E., Cochrane, G.R., Erdey, M.D., and Krigsman, L.M., 2014, Ground-truth studies, Offshore of San Gregorio map area, California, *sheet 6 in* Cochrane, G.R., Dartnell, P., Greene, H.G., Watt, J.T., Golden, N.E., Endris, C.A., Phillips, E.L., Hartwell, S.R., Johnson, S.Y., Kvitek, R.G., Erdey, M.D., Bretz, C.K., Manson, M.W., Sliter, R.W., Ross, S.L., Dieter, B.E., and Chin, J.L. Survey Scientific Investigations Map 3306, pamphlet 38 p., 10 sheets, scale 1:24,000, http://dx.doi.org/10.3133/sim3306.









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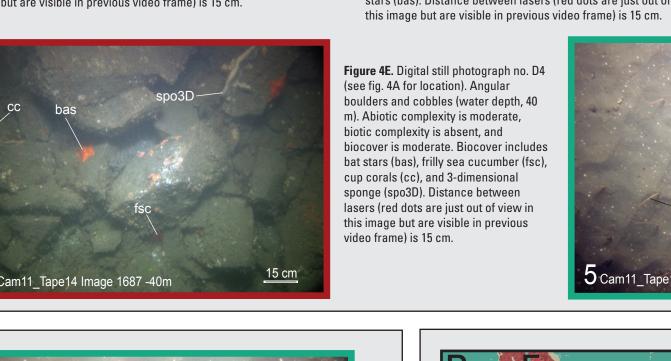
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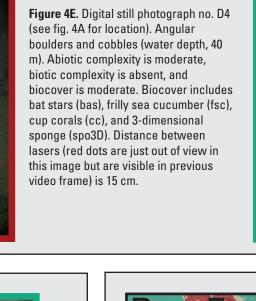
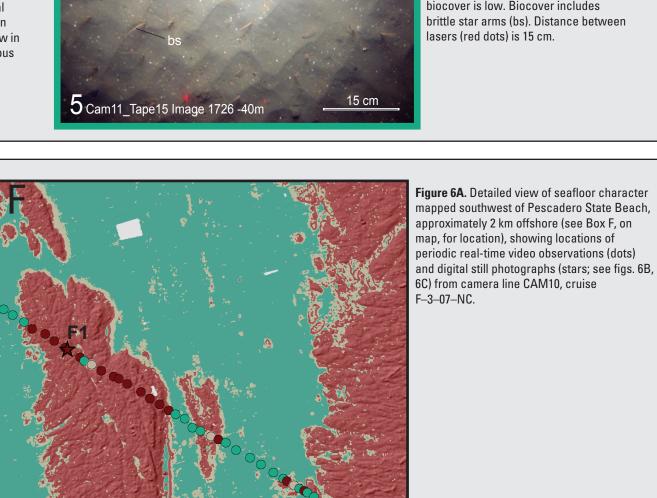
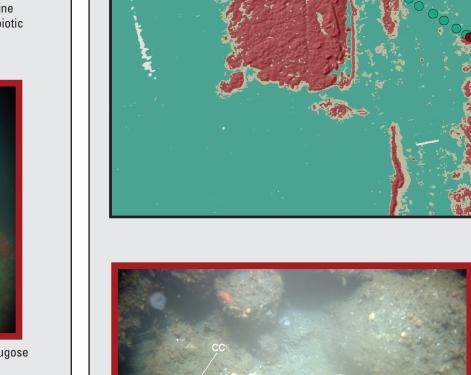
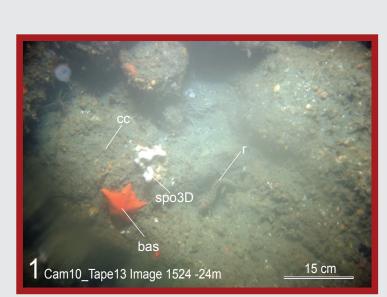
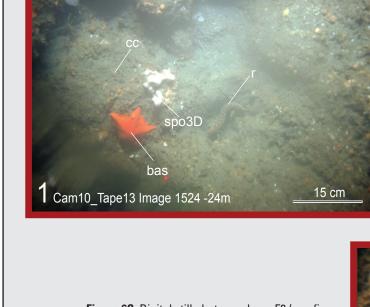


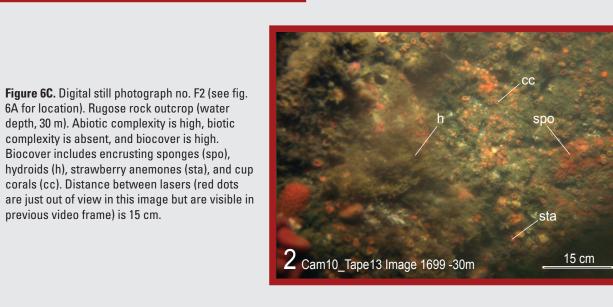
Figure 4C. Digital still photograph no. D2 (see fig. 4A for location).











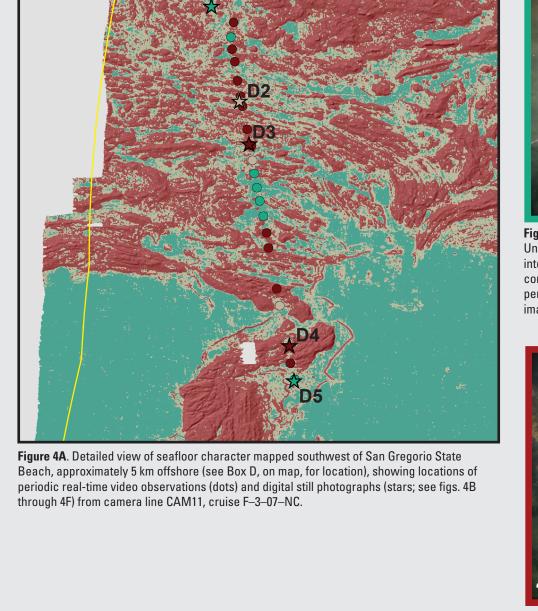


Figure 5A. Detailed view of seafloor character mapped northwest of Pescadero State Beach,

approximately 1.5 km offshore (see Box E, on map, for location), showing locations of periodic

real-time video observations (dots) and digital still photographs (stars; see figs. 5B through 5E)

Figure 5D. Digital still photograph no. E3 (see fig. 5A for location). Mixed

boulders, cobbles, and shell hash overlying rock (water depth, 20 m). Abiotic complexity is moderate, biotic complexity is absent, and biocover

is low. Biocover includes sea anemone (sa). Distance between lasers

(only one red dot is visible in this image, but both are visible in previous

from camera line CAM10, cruise F-3-07-NC.

video frame) is 15 cm.

